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GB 2127643 A GB 2125647 A

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UK CL (Edition J) H4B
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(54) A vehicle monitoring system

(57) A vehicle monitoring system comprising an infra-red radiation transmitter (14) located on the underside of a vehicle to be monitored and an infra-red radiation receiver (18) positioned in the ground at a predetermined location in or adjacent to the path of the vehicle. The receiver (18) is connected via a fibre optic (58) to an infra-red radiation sensor, the vehicle transmitter (14) being adapted to transmit signals pertaining to the vehicle to the sensor via the receiver (18) and the fibre optic (58). The sensor is connected to a control system which interrogates and processes the signals sensed by the sensor.

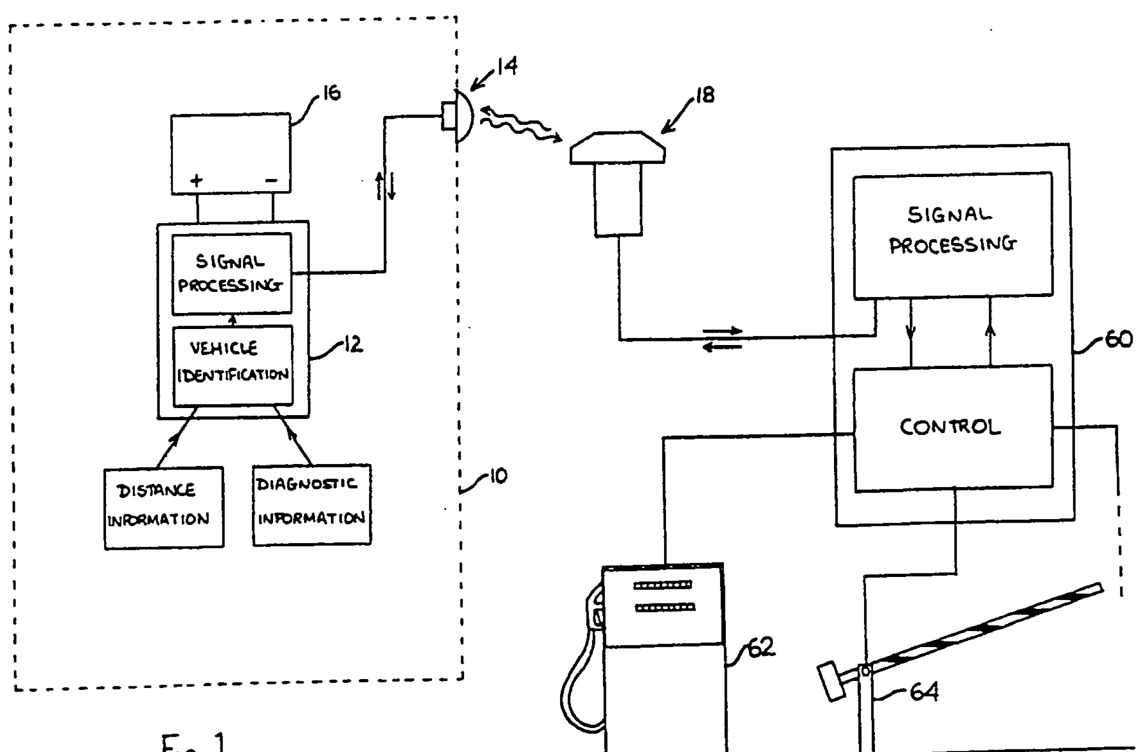

Fig. 1

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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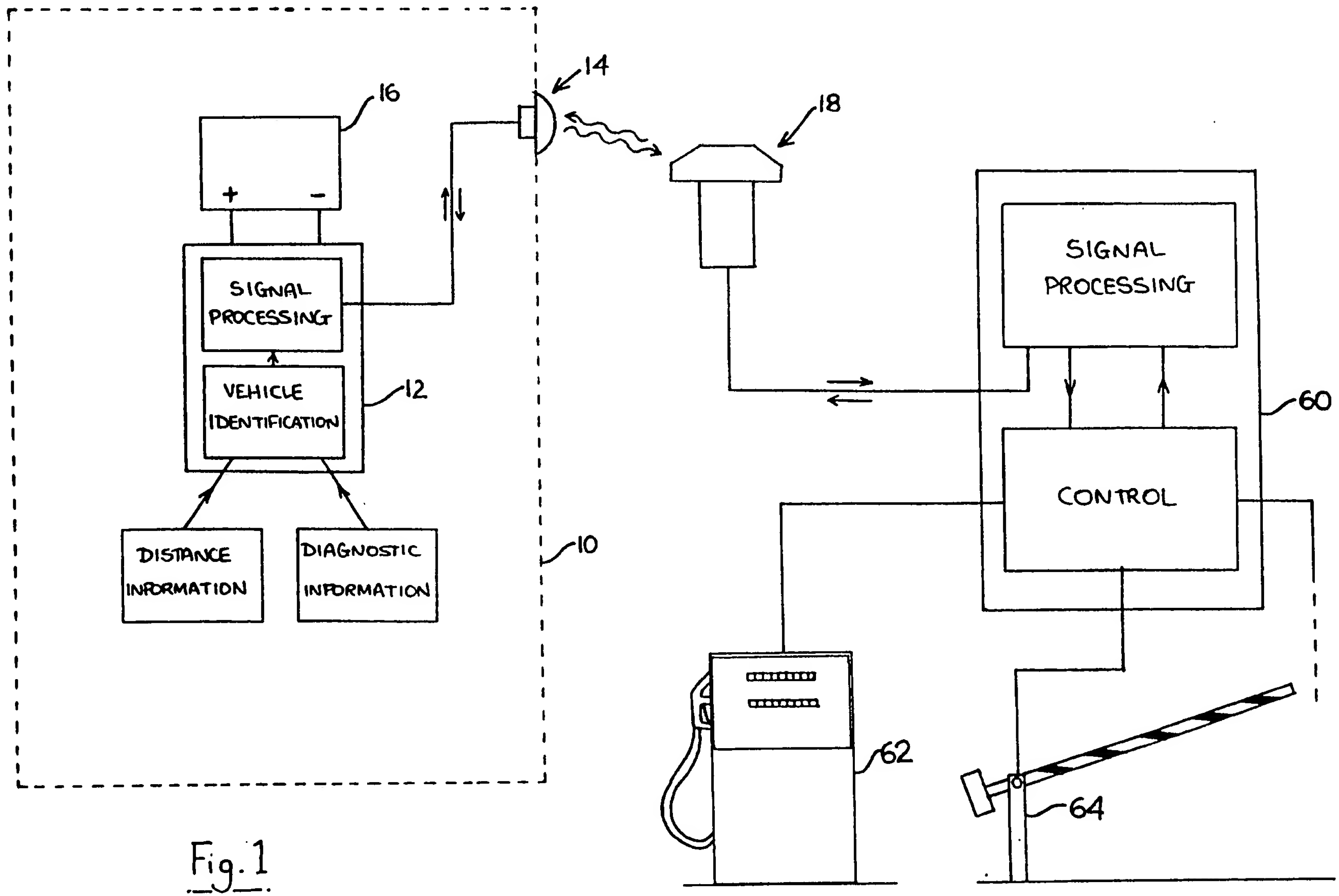
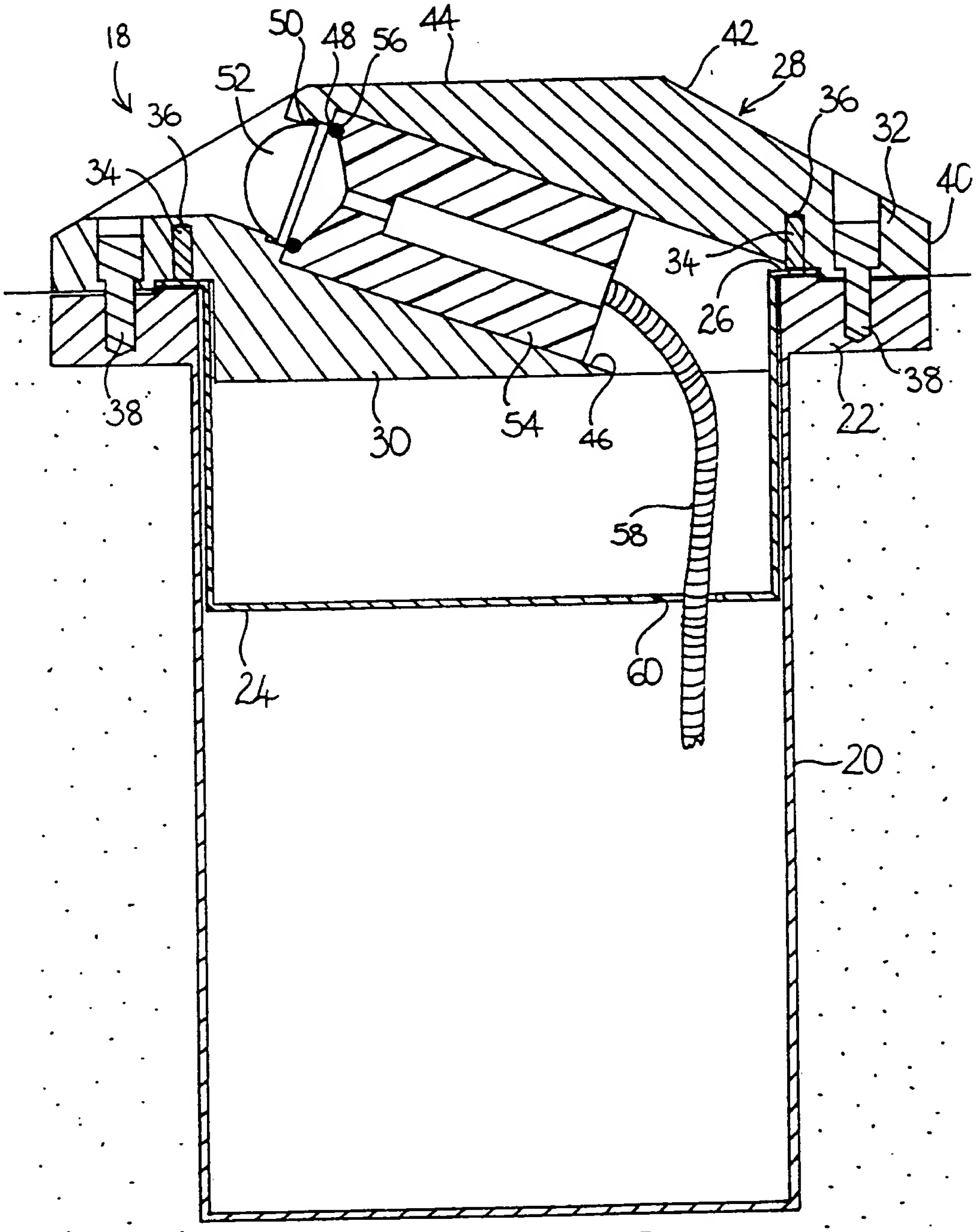

16
+
-
SIGNAL PROCESSING
VEHICLE IDENTIFICATION
12
DISTANCE INFORMATION
DIAGNOSTIC INFORMATION
10
14
18
SIGNAL PROCESSING
CONTROL
60
62
64

Fig. 1


18
50
48
56
44
42
28
52
36
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32
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34
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26
38
38
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46
58
60
24
20

Fig.2

DESCRIPTION

A VEHICLE MONITORING SYSTEM

The present invention relates to vehicle monitoring systems for monitoring data in connection with the operation of a fleet of vehicles.

For efficient operation of a fleet of vehicles it is important that details of fuel used, distance travelled and diagnostic information is available for each vehicle on a regular basis.

Many operators of large fleets of vehicles have on-site fuelling facilities. These require identification of a valid vehicle before fuelling can take place, and allow for entry of other details such as odometer information. Using traditional systems, this information relies on manual input from the fueller of the vehicle and could be incorrect.

It is also possible that other information is available in the form of on-board diagnostics. Using traditional techniques, this information has only been available by manually reading instruments in the cab or by plugging in a diagnostic facility at a service bay.

In one system which has already been proposed for monitoring the amount of fuel dispensed from a delivery conduit to a fuel tank in a vehicle, a data-providing means is arranged to be associated with the

circumference of a tubular entry port leading to the vehicle fuel tank. The data-providing means supplies data relating to that tank and the associated vehicle. The delivery conduit has a nozzle which is adapted to be received into the tubular entry port for delivering fuel to the vehicle tank. The part of the nozzle which is introduced into the entry port carries a data reader which is adapted to read data from the data-carrying means when the nozzle is being inserted into the entry port.

The latter system has the disadvantage that the data-providing means is necessarily associated with the tank entry port itself. For example, it can be disposed wholly around the inner or outer circumference of the tubular entry port. As a result, the data reader has to be located on or in that part of the nozzle which is introduced into the entry port. It is therefore particularly susceptible to damage during the repeated introduction and removal of the nozzle.

In order to overcome this latter problem, it is also known for data to be transmitted from the vehicle to a detector on the nozzle end of a fuel delivery conduit by means of an infrared signal generated by an infrared emitter disposed near to but not directly associated with the fuel entry port

itself. Thus, the infrared emitter is disposed sufficiently close to the fuel entry port such that, when the nozzle is inserted into the entry port an infrared detector on the nozzle lies automatically in a position in which it will pick up infrared radiation transmitted by the infrared emitter.

In the latter known system, the infrared detector has transmitted signals back to a fuel management system electronically, either by way of hard wiring or radio link.

Such known systems have, however, the disadvantage of allowing electrical signals to be present in close proximity to exposed fuel so that, even though these electrical signals are of very low level, the possibility of sparks and ignition of the fuel cannot be totally discounted.

One method of overcoming these problems is the subject of co-pending UK patent application no. 88 15584.1, which discloses an improved system for transmitting the data from a vehicle to a remote fuel management system. However, this system can only be used when a fuel pump nozzle is positioned in the entry port of a vehicle fuel tank, and thus information concerning the vehicle can only be transmitted when the vehicle is being filled with fuel.

There are other circumstances where information concerning a vehicle is desirable at times other than during the filling of the vehicle with fuel. One such situation occurs with access control, for example controlling access to a car park. In existing systems, authorised users are issued with a card which allows entry to and exit from the car park. However, such cards are not restricted to use with a particular vehicle, but allow access to anyone in possession of the card. For example, although the cards are intended for use only by those to whom they are used, it is not unknown for cards to be loaned to unauthorised people who then may park their own vehicle in the car park. Also, the card based systems permit unauthorised access by a genuine holder of the card, such as using the car park for private use outside working hours.

It is an object of the present invention to provide a system which overcomes all the above-mentioned disadvantages.

In accordance with the present invention, a vehicle monitoring system comprises an infra-red radiation transmitter located on a vehicle to be monitored and an infra-red radiation receiver positioned at a predetermined location in or adjacent to the path of the vehicle, the receiver being connected via a fibre optic

to an infra-red radiation sensor, the vehicle transmitter being adapted to transmit signals pertaining to the vehicle to the sensor via the receiver and the fibre optic, and the sensor being connected to a control system which interrogates and processes the signals sensed by the sensor.

Using this system, data can be transmitted merely by driving the vehicle in the vicinity of the receiver, without the need for a fuel pump nozzle to be inserted in the entry port of the vehicle fuel tank. This is of particular benefit for use with access control systems, such as those systems which provide access to a private car park. Since the receiver is mounted on the vehicle, it is effectively the vehicle, rather than a particular person, which is authorised.

The present invention is also of a particular advantage when the system is used in conjunction with the supply of fuel to the vehicle from a fuel filling pump, since the system can be arranged to have only fibre optic leads in the vicinity of the vehicle, and to have the electrical fuel management system located remote from the vehicle to be filled with fuel, thereby minimising any risk of ignition of the fuel from sparks in the vicinity of the vehicle.

Advantageously, the transmitter is mounted on the

underside of the vehicle, and the receiver is mounted in the ground over which the vehicle is to pass.

The system may also be arranged such that information is fed from the control system to a vehicle, and in this case the vehicle is further provided with an infra-red radiation receiver, and an infra-red radiation transmitter is positioned at a predetermined location in or adajcent to the path of the vehicle, the transmitter being adapted to transmit signals to the vehicle-mounted receiver.

This would additionally allow information to be fed to the vehicle, such as zeroing the distance information previously fed to the control system, or correcting or resetting diagnostic information previously fed from the vehicle to the control system.

Advantageously, the transmitter and receiver on the vehicle may be in the form of a single transceiver unit. Furthermore, the other transmitter may be adapted to transmit the infra-red signals through the receiver which is positioned at the predetermined location. Preferably, the infra-red signals to be transmitted to the vehicle are conveyed to the transmitter by means of a fibre optic, which may be the same fibre optic which connects the receiver to the sensor.

One or both of the infra-red transmitters may be in

the form of an infra-red light-emitting diode.

The present invention also includes a unit for mounting in the ground for use with a system as described above, comprising a solid mounting body having an aperture therein in which is positioned a lens which is connected or connectible to a fibre optic leading to a control system.

Preferably, the periphery of the body is inclined in order to allow the wheels of vehicles to pass over the unit, for example in the form of a frusto-conical portion. Preferably, the aperture is located in an inclined face of the unit.

By way of example only, a specific embodiment of the present invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is a diagrammatic representation of an embodiment of monitoring system in accordance with the present invention; and

Fig. 2 is a cross sectional side elevation through a ground-located unit of the system of Fig. 1.

On board each of a plurality of vehicles 10 is a data unit 12 which carries a unique vehicle identification which can be transmitted electronically to a transducer 14. The transducer comprises a light emitting diode (LED) adapted to produce infrared

radiation, in combination with an infrared sensitive cell. The transducer 14 is mounted on the undersurface of the vehicle 10. Other information relating, for example, to distance travelled and diagnostic tests, can be supplied to the data unit 12 and hence, in the form of a coded infrared signal, to the transmitter unit 14. The data unit 12 and the transducer 14 are conveniently powered by the vehicle battery system 16.

Although infrared radiation is used in this embodiment, it should be noted that any electromagnetic radiation may be used. For example, visible light may be used.

Distance information can, for example, be generated by a tachograph (not shown), or by measuring a rotation proportional to distance travelled, i.e. rotation of an odometer drive, drive shaft or road wheel.

Diagnostic information can be obtained from any of a number of sources such as a plurality of simple on/off alarm signals, or oil temperature or pressure sensors, water temperature sensors, light failure sensors, worn disc pad sensors, or from a more sophisticated on-board diagnostic system.

The system also includes a further transmitting and receiving unit 18 which, in use, is mounted in the ground in the path of vehicles. As best seen in Fig. 2,

the ground unit has a number of discrete components. The first of these is a tubular metal cannister 20 which is closed off at its lower end and open at its upper end, the upper end being provided with a robust exterior circumferential flange 22. A cup member 24 is a press fit within the canister 20. The lower end of the cup 24 is closed off and the upper end is open. The upper is also provided with an exterior circumferential flange 26 which, in use, rests upon the upper portions of the flange 22 of the canister 20.

A central cylindrical portion 30 of a road stud portion 28 is received within the cup 24. A radially outward portion 32 of the road stud portion rests upon the flange 26 of the cup 24 and also on the flange 22 of the canister 20, the road stud portion being located by receiving two diametrically opposed cylindrical lugs 34 extending from the flange 26 of the cup 24 in appropriately positioned cylindrical recesses 36 in the road stud portion. The road stud portion is securely held in place by means of two bolts 38 which pass through the abutting flanges 32, 26 and 22 of the road stud portion, the cup and the canister 20 respectively.

The outer surface of the road stud portion has a cylindrical portion 40 connected to a frusto-conical portion 42, and a flat, circular upper portion 44.

It will also be noted that the road stud portion 28 is provided with a cylindrical bore 46 which is inclined at an angle of 20^{o} to the plane of the upper circular portion 34. The bore 46 is provided with two shoulders 48, 50 adjacent to its upper end. A hemispherical glass lens 52 rests against the shoulders and is held in contact therewith by means of an elastomeric plug 54 fitted in the bore 46, the elastomeric plug bearing against a seal 56 which itself bears against the interior surface of the lens 52.

The lens 52 is optically connected in a conventional manner to a fibre optic 58 which passes sealingly through the plug 54. The fibre optic 58 then passes through an aperture 60 in the base of the cup 24.

In use, the canister 20 is set into the ground and permanently fixed therein such that the upper surface of the peripheral flange 22 is level with the ground level. The cup 24 is then located within the canister 20 so that its flange abuts the upper portion of the flange 22. The lens 52, the seal 56, the plug 54 and the fibre optic 58 are then assembled and inserted into the bore of the road stud portion, such that the lens 52 faces outwardly and upwardly, the road stud portion then being inserted in the cup 24 and secured by means of the bolts 38.

In use, a vehicle approaches the location and passes over the assembly buried in the ground. This allows information which is transmitted by the LED of the transducer 14 in the form of coded infrared signals to be received by the lens 52 and conveyed along the fibre optic 58, and thence to a data monitoring unit 60 situated remote from the ground unit 18. The signals from the LED of the transducer 14 may be continually transmitted, or may be transmitted upon operation of a switch by the driver of a vehicle when in the vicinity of the ground unit 18, where a transducer converts the infrared signals to electrical signals. The coded signals normally include the vehicle identity and may include other information such as the distance travelled by the vehicle and diagnostic information. If the vehicle is determined by the system 60 to be valid, a control mechanism of the data control system allows operation of the unit to which the vehicle requires access. For example, in the embodiment of Fig. 1, the control is adapted to allow use of a fuel pump 62 and to operate a barrier 64 to allow the vehicle to proceed. However, these two examples are given by way of illustration only, and the present invention is not restricted to operation of a fuel pump and/or operation of a barrier. Indeed, if there were a plurality of

ground units 18, and if the vehicles were adapted to transmit signal continuously, then it would be possible to monitor the position of each vehicle in the area covered by the ground units 18.

In the embodiment illustrated, it is also possible to transmit information from the data control unit 16 back to the vehicle 10. In this regard, the transducer of the data monitoring unit is provided with an LED which produces coded infrared signals which are conveyed to the lens 52 of the ground unit via the fibre optic 58. These signals are picked up by the receiving portion of the transducer 14 of the vehicle, and are conveyed to the data unit 12 in the form of electrical signals. In this way, various items of the vehicle data may be reset, for example the distance information and diagnostic information may be zeroed or reset.

Bi-directional transmission is useful in that, for example, the management system can be arranged to transmit a coded signal and it is only on receipt of this coded signal that the information is passed back to the management system from the vehicle regarding the vehicle data.

Thus, for example, upon receipt of the coded signal from the management system 18, the transducer 14 on the vehicle may be arranged to send a further coded signal

back to the management system, comprising the vehicle identity and the distance and diagnostic information. If the vehicle is determined by the management system to be valid, the management system then enables the operation of the device as appropriate, for example operation of a fuel pump or of a barrier.

However, it should be noted that it is not essential for the transmission to be bi-directional, but it is most useful if certain circumstances.

The invention is not restricted to the details of the foregoing embodiment.

CLAIMS

1. A vehicle monitoring system comprising a radiation transmitter located on a vehicle to be monitored and a radiation receiver positioned at a predetermined location in or adjacent to the path of the vehicle, the receiver being connected via a fibre optic to a radiation sensor, the vehicle transmitter being adapted to transmit signals pertaining to the vehicle to the sensor via the receiver and the fibre optic, and the sensor being connected to a control system which interrogates and processes the signals sensed by the sensor.

2. A sytem as claimed in claim 1 in which the transmitter is mounted on the underside of the vehicle, and the receiver is mounted in the ground over which the vehicle is to pass.

3. A system as claimed in claim 1 or 2 , wherein the vehicle is further provided with a radiation receiver, and a second radiation transmitter is positioned at a predetermined location in or adjacent to the path of the vehicle, the transmitter being adapted to transmit signals to the vehicle-mounted receiver.

4. A system as claimed in claim 3, wherein the transmitter and receiver on the vehicle are in the form of a single transceiver unit.

5. A system as claimed in claim 4, wherein the second transmitter is adapted to transmit the signals through the receiver which is positioned at the predetermined location.

6. A system as claimed in claims 3, 4 or 5, wherein the signals to be transmitted to the vehicle are conveyed to the second transmitter by means of a fibre optic, which may be the same fibre optic which connects the receiver to the sensor.

7. A system as claimed in any of claims 1 to 6 wherein the radiation is infra-red radiation.

8. A system as claimed in claim 7, wherein the or each radiation transmitter is in the form of an infra-red light-emitting diode.

9. A system as claimed in any of claims 1 to 8 including a unit for mounting in the ground, the unit comprising a rigid mounting body having an aperture therein in which is positioned a lens which is connected or connectible to the fibre optic leading to a control system, containing the radiation sensor.

10. A sytem as claimed in claim 9, wherein a peripheral face of the mounting body is inclined in order to facilitate the passage of the wheels of vehicles over the unit.

11. A system as claimed in claim 10 in which the inclined periphery is in the form of a frusto-

conical portion.

12. A system as claimed in 9, 10 or 11, wherein said aperture is located in said inclined peripheral face of the unit.

13. A vehicle monitoring system comprising an infra-red radiation transmitter located on a vehicle to be monitored and an infra-red radiation receiver positioned at a predetermined location in or adjacent to the path of the vehicle, the receiver being connected via a fibre optic to an infra-red radiation sensor, the vehicle transmitter being adapted to transmit signals pertaining to the vehicle to the sensor via the receiver and the fibre optic, and the sensor being connected to a control system which interrogates and processes the signals sensed by the sensor.

14. A vehicle monitoring system, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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